THE SCHOBER REVERBATAPE UNIT RV-1

SERVICE MANUAL

This manual contains information on servicing the Reverbatape Unit RV-1 in case of malfunction, and also has some general information on installation. A copy is supplied to each Reverbatape dealer. Dealers may secure additional copies necessary for installation and service personnel on request.

It is obviously impossible to furnish in printed literature all possible information which a user, installer, or purchaser might wish under special circumstances. If you require any aid or information in addition to that contained in this Service Manual or other Schober literature, do not hesitate to request it of The Schober Organ Corporation.

INSTALLATION

To install a Reverbatape Unit in an organ (or audio system), a plug-in attenuator, input and output cables (sometimes with special connectors or tube-socket adapters), the plastic control box, and a set of wood screws are necessary. These items are contained in the Installation kits, and one such kit is supplied with each Reverbatape Unit. The type of attenuator and the cable terminations are different for each make and model of organ. Therefore, several Installation Kits are available, each one suitable for one or more particular organs. Each Kit also contains an instruction sheet giving detailed procedures for installation in the organs for which that Kit is used. It is therefore essential that the make and model of the organ for which a Reverbatape Unit is intended be specified when the Unit is ordered from Schober.

A dealer may wish to stock several Reverbatape Units so that he can deliver them to customers without delay. He may then need to stock several types of Installation Kits to cover the various kinds of organs his customers may have. Extra Installation Kits are available. The price of each Installation Kit, as well as a list showing makes and models of organs covered by each Kit are supplied to each dealer on a special sheet. New versions of this sheet are mailed to Reverbatape dealers as revisions come into effect as the result of organ manufacturers' model changes and availability of installation data on additional models.

There are so many organ models in existence that inevitably some, especially older, noncurrent models may not be covered by specific instruction sheets. For this reason, information is given in the "Special Organ Installations" section on page 2 which will enable a technician of reasonable competence to devise his own connection procedures. Both that section and the one on "Audio System Installations" should be consulted when a Reverbatape Unit is to be used elsewhere than in an electronic organ.

General Installation Notes

This section gives some general information about installations in organs for which a specific Installation Kit is listed. Such kits contain all necessary instructions as well as materials.

Installation is in three parts. First the three parts of the Reverbatape Unit must be mounted in the organ console — the Main Unit with the tape mechanism, the Power Supply, and the Control.

The Main Unit has mounting brackets which are secured to it during shipment. The brackets may be used to hang the Unit from an overhead horizontal wood panel or a vertical panel, or to secure it atop a horizontal wood panel. The brackets are fastened to the wood of the console with wood screws (supplied), and to the Unit with self-tapping hex-head screws, which are in place when the Unit is shipped.

The Power Supply chassis has a flange at each end; the flanges are used to fasten the Supply to any wood part of the organ, in any position, with the screws supplied.

The Control, a 3-gang potentiometer, may be mounted behind a convenient wood panel such as the stop board or a cheek block, for which a small metal bracket is supplied and a 5/8" hole must be drilled in the wood. Alternatively, it may be placed within the plastic control box (furnished for all organs except Schober), and the box then fastened to the trim strip beneath the lower manual, either with a pair of screws or with the special nonmarring adhesive pad furnished. If the box is used, a 3/4" hole must be drilled near the top of the organ toeboard for the control cable. A decal is furnished for use when the control is panel-mounted.

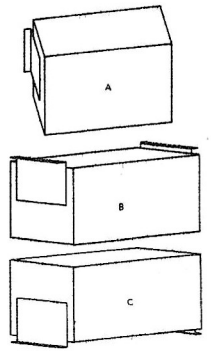

Fig. 1 — The three Main Unit mounting methods. (A) On vertical wood panel behind Unit. (B) From horizontal panel above. (C) On horizontal panel below.

In some cases a particular organ may contain extra equipment which makes mounting the Reverberation units in the locations given by the instruction sheet impossible. In such cases, any other convenient locations may be chosen. The Main Unit should not have the magnetic heads near a radiator of 60-cycle a.c. such as a power transformer or a magnetic field such as that of a loudspeaker magnet. And the Reverbatape Power Supply should be placed, when possible, so that the Main Unit box walls come between it and the heads, so as to shield the heads from the field of the power transformer. The ends of the Main Unit should be far enough from a nearby console wall so that a nutdriver may be used to dismount the Unit from the end brackets for service without unscrewing the brackets from the console.

Fig. 1 shows the three methods of mounting the Main Unit. A is for vertical panels, B for hanging from over-

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head panels, and C for vertical panels below, such as the console floor. In each case, the front face of the Unit should be accessable without removing the Unit from its brackets.

All Units (except the earliest production) are shipped with metal-plastic covers over the heads and tape. This should be left in place during installation to avoid damaging or moving any of the elements. It need be removed only to change or straighten the tape.

To connect the system electrically to the organ, three operations are required. The instruction sheet gives them in detail. They involve audio input and output and the a.c. line supply. These connections may be made with connectors or tube socket adapters, or they may require soldering. All connectors and adapters needed are furnished in the Installation Kit. The 7-pin plug at the end of the control cable must be plugged into the Main Unit control socket, and the power cable from the Main unit must be plugged into the Power Supply. For neatness and security, all cable lengths which are excessive should be rolled up neatly and tied with a bit of wire, string, or tape. Cables should be fastened at intervals along their routes. For this latter purpose, extra adhesive pads are provided. These should be cut up and small pieces used for fastening down cables.

The following tools are the minimum required for installation: a diagonal cutter, screwdrivers, ¼-inch nutdriver, awl, ¼-inch electric drill, ⅝" flat wood bit (for panel mounting of control) or ¾" flat wood bit (if control box is used), small soldering iron or gun, and rosin-core electronic solder.

Each Installation kit contains a small plug-in attenuator. Before the Main Unit is placed in the organ, the attenuator must be installed in the Unit, with the phenolic back plate temporarily removed. A 7-pin socket will be seen on the chassis inside for the attenuator.

Special Organ Installations

Where no specific instruction sheet is available for an organ, a technician must determine the installation method. For such organs, Installation Kit IK-2 should be ordered. This contains, in addition to the control box and cables, one each of the 5 attenuator types and a variety of connectors and adapters. If a dealer intends to sell several Reverbatape Units for organs on which no instruction sheet exists, he may, after determining the materials necessary, order a special kit containing only what is needed.

The three units are mounted in whatever locations appear convenient. Then, prefably with the aid of a schematic diagram, the technician locates the earliest point following the organ swell shoe at which the Reverbatape Unit can be interposed. A typical example is between two voltage-amplifier stages. Output from the plate of one stage is connected (through the blocking capacitor) to the Unit input; Unit output is then connected to the following grid. If the swell shoe is a potentiometer, often the wiper can be used for the Unit input. Instructions for finding suitable connections are included in the IK-2 Installation Kit.

Temporary Organ Installations

It may be desirable in many cases to make a temporary installation, for instance as a demonstration in a customer's home. For this purpose the dealer should use a Reverbatape Unit with the Control mounted in the plastic control box and should use the input and output cables from the Installation Kit intended for the organ in question. The Unit may be placed on top of the organ, with the Power Supply as far away as the power cable will permit and somewhat to the rear of the Main Unit to prevent direct radiation of magnetic field from the power transformer to the magnetic heads. The audio cables are long enough to go to any point within most organs with this setup. The Power Supply line cord can simply be plugged into a nearby wall outlet. Lacking more elaborate demonstration procedure, the control box can also be placed atop the organ, perhaps weighted down with a book or two.

Such temporary installations should take no more than a minute or two plus time to take the back off the organ if there is one.

Audio System Installations

The Reverbatape Unit may be used in home audio systems to add reverberation to records, radio, and tape-recorder material, and in amateur and professional recording and public-address systems.

For a straight "high-fidelity" system having a separate preamplifier, output of the preamplifier is fed to the Reverbatape Unit input and the Unit output is then fed to the power amplier. The highest-voltage attenuator is used and the preamplifier and power amplifier gain controls are adjusted for best signal-to-noise ratio. Generally phono connectors are employed.

Stereo systems require two Reverbatape Units if both channels are to have reverberation.

Installation Kit IK-3 is especially for nonorgan installations. Its contents include one attenuator, two cables, and a pair of phono connectors. No control box is included but there is a plate for wood-panel control mounting. Instructions give available installation information, but if the system is not the usual simple preamplifier-amplifier combination, the user may have to devise his own installation method or employ a technician for the purpose.

THEORY OF OPERATION

A detailed description of the functions and operational theory of the Reverbatape Unit is given in a separate article enclosed with this manual. It is not necessary to understand this to install or service the Unit, but technically trained people will benefit from reading the article.

Generally speaking, the Reverbatape Unit is a special-purpose tape recorder, which constantly records the signal and then plays it back at intervals of about 0.11 second for a length of time determined by the Control setting. Reverberation time is variable from about 6 seconds down to zero. At each setting the decay is a natural one. There is also a direct channel through which the signal passes without alteration.

The multiple repetitions simulate the multiple bounces of sound against the boundaries of an auditorium. The control setting determines how much energy is lost at each bounce — in effect how hard the walls are. The gains of recording and playback amplifiers are carefully calibrated at the factory to give the correct effects.

The Reverbatape Unit is inserted in the audio system of an organ. It has unity gain; that it, its output is about the same as its input. Effectively, therefore, it does not in any way change the performance or mode of operation of the organ and requires no special amplifier or speaker.

The Unit is very easy to use. Hints on setting the control for various kinds of music are given in the Owner's Manual.

SERVICING

Like all electronic and mechanical equipment, the Reverbatape Unit may at some time develop trouble and require repair. This section gives instructions on dealing with the

mechanism, and replacing tapes, tubes, and modules, and includes a list of typical symptoms with indications of which modules are probably at fault. A table of voltages is also provided.

Factory Service

While some general data is given below concerning the mechanism, it is strongly recommended that no field repairs be attempted on it except those which are obvious and are within the *certain* knowledge of the service personnel. The mechanism is carefully made and includes adjustments which are vital to its performance. These adjustments cannot easily be made outside the factory.

Where trouble is due to the mechanism, therefore, it should be returned to The Schober Organ Corporation for repair. A guarantee card is furnished with each Unit, and this should be returned to the factory by the customer at time of installation. If a returned Unit is within the warrantee period of 1 year from the date on the card on file, no charge will be made for service; past that time, a small standard charge will be made.

Tubes should be replaced, where necessary, from dealer's stock of 12AU7 and 12AX7 types. If the 90-day guarantee on tubes has not expired, the tube may be returned to Schober and a new one will be supplied in exchange.

Each dealer should have on hand a complete set of spare modules (see dealer price list). Failing that, a module from a Unit in stock may be used. Faulty modules may either be repaired by the dealer or returned to the factory for repair on an exchange basis. After expiration of the 1-year warrantee period, a small standard charge will be made for each such exchange.

The dealer should stock a few replacement tapes (see price list).

Whenever material is returned to the manufacturer for repair or exchange, a letter should accompany it stating in detail exactly what the trouble is.

Each dealer may, in addition, expect full cooperation from the factory in solving any problems which may arise. Letters and telephone calls will receive prompt attention.

The Mechanism

Fig. 2 is a photograph of the tape mechanism. The tape itself is contained in a special plastic cartridge (see replacement instructions in a following section). The tape is about 22 feet long and its ends are spliced together, so that in effect it is an endless loop. Tape emerges from the long slot, at the right side of the cartridge in the photo, and enters the cartridge through a slot on the rim at the left.

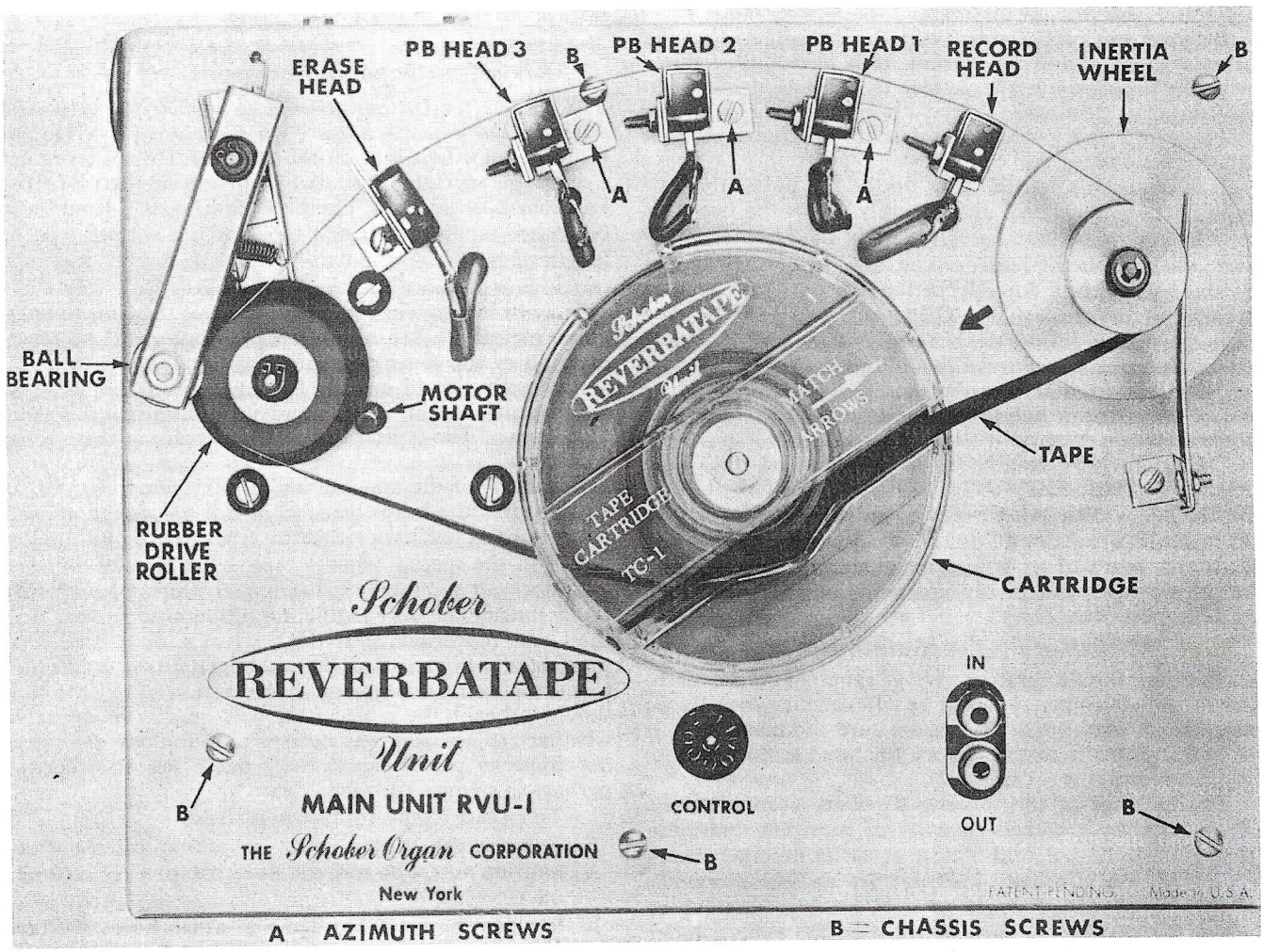

Fig. 2 — The Main Unit, with the components indicated. This face should always be accessible after mounting.

As the tape emerges from the cartridge it passes around the brass inertia wheel at right and is held against the wheel by a spring-loaded strip of felt. The surface of the tape which contacts the felt is graphite-lubricated, so the felt does not wear appreciably. The inertia wheel is free to rotate on its shaft. Its purpose is to smooth out any variations in tape speed introduced by irregularities in the rotating hub within the cartridge.

The tape then passes over the five magnetic heads —

one record and three playback, then erase — and then around a rubber roller. It is pressed firmly against the roller by a ball-bearing on a spring-loaded arm.

The rim of the roller rests lightly against the motor shaft, which protrudes through a hole in the steel panel. The shaft causes the roller to rotate, pulling tape from right to left. Because the tape is not perfectly free to move (the inertia wheel and felt pad cause a certain amount of resistance), pulling tape from right to left causes the arm on which the rubber roller is mounted to be drawn toward the right, snubbing the rim of the roller tighter against the motor shaft. This is what gives positive drive when the system is operating, even though at standstill the roller does not press against the motor shaft heavily enough to cause deformation of the rubber. The tape then goes from the roller back into the cartridge.

Between the rubber roller and the cartridge input the tape is under almost no tension. If it were pulled down with the finger, quite a large free loop would exist; when the finger is removed, the tape would slowly pass into the cartridge and would again describe an almost straight line between roller and cartridge.

It is important that the Unit not be run unless the tape is in its proper channel and squarely across the heads. If it is not, place it there before running the Unit. If necessary, slack across the heads can be taken up. Move the hub of the ball bearing forcibly to the left until the bearing separates from the rubber. Then place and pull the tape as necessary and release the bearing. Now, when the motor starts, the slack between roller and cartridge will be taken up. Do not attempt to push tape into the cartridge or rotate the cartridge hub by hand. Be careful to avoid twisting or creasing the tape.

IMPORTANT: DO NOT TIGHTEN OR TRY TO ADJUST THE AZIMUTH SCREWS. THESE HAVE BEEN FACTORY ADJUSTED FOR CORRECT HEAD ALIGNMENT. Also, do not try to adjust the spring arm with the felt pad or rotate its mounting bracket. The adjustment set at the factory must be retained.

Servicing the Mechanism

Servicing should rarely if ever be required on the mechanism, and attempts at repair or adjustment generally do more harm than good. If you are sure the mechanism is at fault, return it to the factory for service. Such service is prompt and charges are small.

The bearings of the rotating parts are porous bronze. They carry an absorbed quantity of lubricant and additional lubrication should almost never be necessary. Lack of lubrication is usually indicated by squeaking sounds. If this occurs, a few drops of light machine oil may be placed on the felt washers in front of the rubber roller and brass inertia wheel. Be very careful to use very little oil, as too much may emerge with heat and drip down. Be very certain oil is needed before applying it. Normally, thousands of hours of operation are needed before lubrication is necessary.

After several hundred hours of running (usually 1 to 3 years in a home installation) it is sometimes useful to clean the magnetic heads, especially if brown material can be seen on their upper faces. Ordinary rubbing alcohol can be used, but head-cleaning solution such as Ampex Head Assembly Cleaner 087-007 is better. It may be purchased from Ampex tape recorder dealers. Do not get this on the rubber roller, which should be cleaned only with alcohol. *Be careful not to get any liquid whatever on the tape.*

In determining whether the mechanism is running correctly, it would be normal to hold a steady tone on the organ and listen for excessive wow or flutter with the Control advanced to a setting of 7 or more. Under these conditions, however, note that you will not get a *perfectly* steady tone. The brass inertia wheel has deliberately been held to a smaller size than would assure perfectly steady tape speed. What remains is a very small amount of random speed variation whose function is to give to the normally rock-steady electronic tones a small amount of "pitch movement" to achieve the warmth and the "human" quality found in the tones of orchestral players and air-excited pipes.

The pitch variations heard should not, however, be cyclic, steady repetitive pulsations, as this would indicate wow which is not normal. Neither should they be at a high speed rate equivalent to the rate of rotation of the motor shaft. If they are, it is likely that the flywheel has not been fastened to the rear shaft of the motor.

Tape Replacement

WARNING: *Do not attempt to replace the tape with anything but a new Schober Tape Cartridge TC-1.* Do not try to put new tape into an old cartridge. Do not try to use a cartridge which looks similar but has been obtained from any source other than The Schober Organ Corporation. No other tape or cartridge contains the correct type or length of tape. Use of anything other than a Schober tape cartridge will cause fouling of the heads in a very short time, with consequent complete failure of the Unit to operate. It may also upset calibration and cause either no reverberation or too much feedback, and oscillation.

Each tape should operate for an absolute minimum of 500 hours, which in the average home installation is from 1 to 2 years. The typical tape will last twice or three times this long.

Condition of the tape cannot be determined visually. Its passing over the heads tends to give it a polished appearance which in ordinary recording tapes would indicate lost oxide. In the special Schober tape, however, the polished look does *not* necessarily indicate wear which would justify replacement. The only usable indication of tape wear is in the Unit's performance. If the Control must be turned up substantially higher than when the tape was new in order to get the same amount of reverberation effect, the tape should probably be replaced. It will quickly be apparent whether replacement was necessary. If the new tape does not improve performance, the trouble lies elsewhere — perhaps in an over-age tube.

To replace a tape, follow these steps:

1. Remove the plastic cover by taking off the three knurled nuts. (Be sure the Reverbatape Unit is turned off.)
2. Remove the large knurled nut which holds the tape cartridge on its post.
3. Carefully pull the felt-pad spring arm to the right, just enough to allow you to remove the tape from the brass inertia wheel.
4. Pull the hub of the ball bearing to the left enough to remove it from the rubber roller, and take the tape off the roller.
5. Pull the cartridge firmly off its post and put it aside.
6. Remove the new tape cartridge from its carton, being careful to avoid pulling or creasing the tape.
7. Push the new cartridge in place over the hub on the Unit and rotate it until the gold arrow on the cartridge coincides with the black arrow on the steel panel. Replace the large knurled nut.
8. Carefully, without twisting the tape, pull enough from both sides of the cartridge to give you a big enough loop to go around the rollers and heads. Pulling too

much is not harmful as long as you do not pull past the point where it emerges from the cartridge freely.

9. Lift the felt pad away from the inertia wheel and place the tape around the wheel, setting it inside the "track" on the wheel. Be sure it is not twisted and comes straight out of the cartridge. Pull it until the section of tape between cartridge and head has little or no slack.
10. Lay the tape neatly across the heads from right to left and inside the tape guide fastened to the erase head. Then pull the ball bearing away from the rubber roller and place the tape around the roller. See that the section of tape from roller to cartridge is not twisted, even though it may be quite long and may even lie on the surface to which the Unit is mounted.
11. Turn the Unit on and watch the slack between roller and cartridge as it is taken up. If anything happens to dislodge the tape from its normal path, stop tape travel immediately by pulling the ball bearing away from the rubber wheel. Correct the situation; then release the ball bearing.
12. When the tape is travelling normally and all slack is taken up, replace the plastic cover.
13. Check operation by actually listening to the reverberation effect and watching the tape. If you have accidentally creased or twisted the tape, this may cause snarling or some other kind of poor operation, or it may cause a dropout of reverberation effect or a sudden wow at some point in the tape travel. If so, the tape should not be used. Do not try to remove a damaged section by cutting and splicing.

Chassis Repair

The chassis of the Reverbatape Unit is a flat metal plate with a corner cutout for the motor. It is mounted to the rear of the Main Unit front panel by threaded metal spacers held by the five chassis screws shown in Fig. 2.

As Fig. 3 indicates, the chassis contains only three components which are capable of causing trouble as the result of wear or age. Capacitors C30 (.022-mfd tubular) and C6 (.005-mfd disc) are attached to the 101 (input stage) module socket. The oscillator transformer is mounted over the rectangular cutout. Failure of these capacitors is extremely unlikely, as no d.c. is applied to them. It is conceivable that the primary of the transformer could open; the result would be lack of bias and erase current. Old music on the tape would play back and no reverberation would be heard since the lack of bias would make recording level very low. An ohmmeter check of the coil through pins 5 and 3 of the 104 (oscillator) module socket (with the module removed and the Unit turned off) should show about 100 ohms if the coil is good.

The remaining items on the chassis are merely wires and sockets interconnecting the modules and supplying power.

If chassis removal should be necessary, remove the five

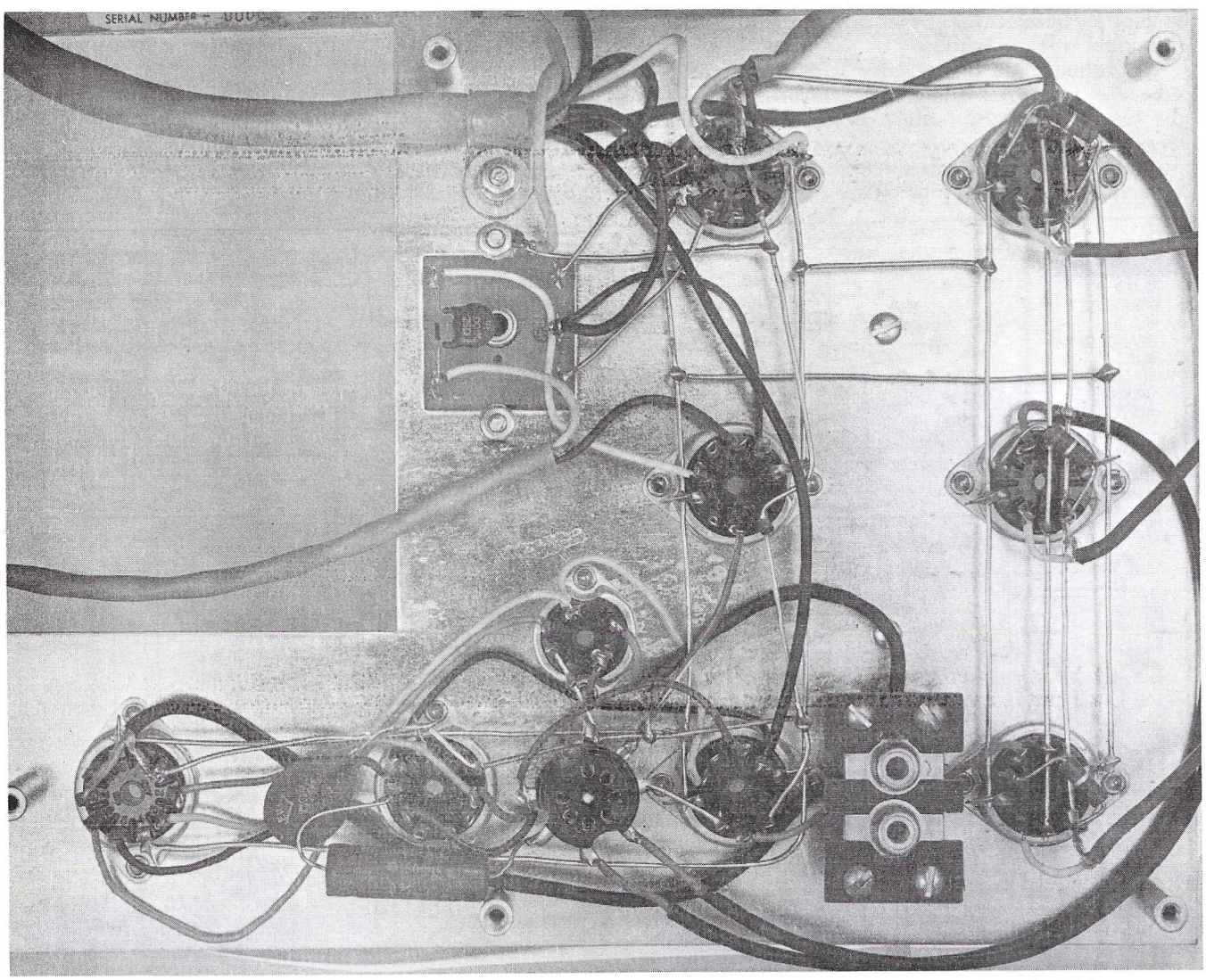

Fig. 3 — Inside of chassis, showing wiring and components which are normally between chassis and inside of front wall of Unit.

chassis screws shown in Fig. 2. Then ease the chassis out, power-cable side last, pushing the power cable into the box as necessary. If necessary to take the chassis farther out than just enough to see inside it, the magnetic head leads must be unclipped and possibly the motor wires unsoldered. Make careful note of which cable goes where. Chassis removal should rarely be necessary. If module repair does not cure a fault, it is recommended that the Unit be returned to the manufacturer for repair.

Voltage Measurements

Fig. 4 is a complete schematic diagram of the Main Unit, including the 3 potentiometers of the Control. Fig. 5 is a diagram of the Power Supply. Notice in Fig. 4 that each dual-triode stage and its components is enclosed in a dashed-line box representing one of the plug-in modules, and that these boxes are numbered 16101, 16102, 16104, 16105, 16106, and 16107, plus an Attenuator. All of the components except C6, C30, and oscillator transformer 0314 are mounted on these modules.

Almost all troubles in the Reverbatape Unit are caused by failure of a component in a module. Pinpointing the proper module is possible without instruments, simply on the basis of the symptom chart in the final section of this manual and the common sense of the repairman (or even just on a blind trial basis.)

However, sometimes it is convenient to trouble-shoot by voltage measurement. For that reason, the following table of normal voltages is given.

All voltages are d.c. positive with respect to ground (the steel case). All voltages are measured on the pins of the *tubes,* not on the module sockets. To make measurements, remove the phenolic rear cover which has the white printing, by taking off the three 6-32 nuts. You will then have access to the tube pins on the copper surfaces of the "U" printed circuits on which the tube sockets are mounted. Keep in mind that you are looking at the tops of the tubes, so the pin numbering goes *counterclockwise.* Make sure you are at the right tube in each case by referring to the lettering on the phenolic cover plate.

All measurements shown were made with the Control set at 0 and the Unit running normally, with the Control plug in its socket. Line voltage was 120 at 60 cycles, and a 20,000-ohms-per-volt meter was used. Measurements within about 20 percent of those shown should be considered normal. However, voltages on pins 1 and 3 of V4, 5, and 6 may vary somewhat more because of the presence of the factory-selected calibration resistors.

V1, Pin 1	56
2	2
3	0
6	45
7	0
8	1.2
V2, Pin 1	56
2	0
3	6
6	100
7	0
8	3.6
V3, Pin 1	180
2	—6
3	3.3
6	180
7	—6
8	3.3
V4, V5, V6, Pin 1	150
2	0
3	1
6	160
7	0
8	1.1
V7, Pin 1	215
2	0
3	1.8
6	215
7	0
8	1.8
V8, Pin 1	132
2	0
3	1.2
6	305
7	2
8	17

On all modules, about 6.3 volts *a.c.* should appear between tube pins 4-5 and 9.

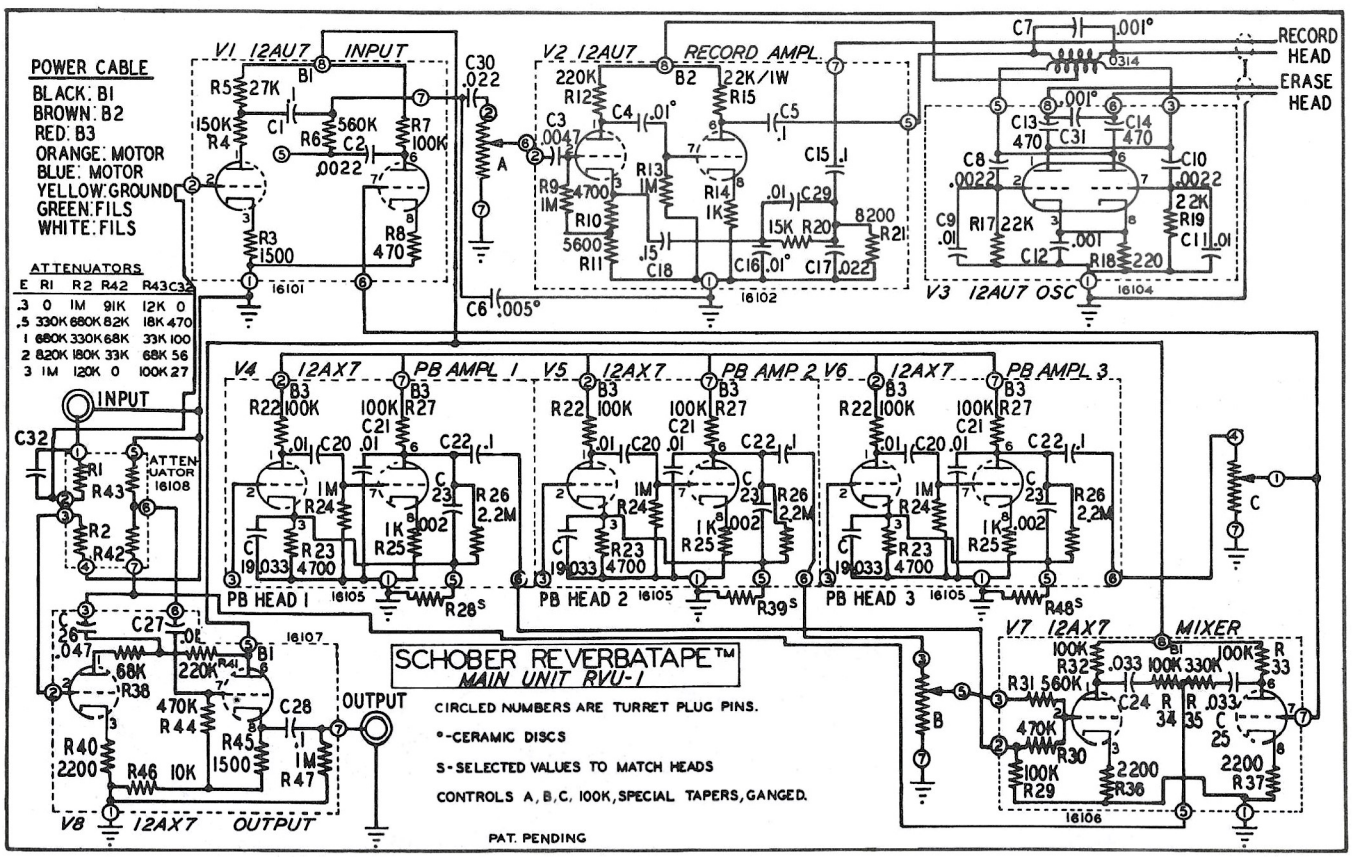

Fig. 4 — Complete schematic of the Main Unit, including the three sections of the Control (A, B, and C).

Troubleshooting

This section consists of a list of symptoms and probable cures. Where a module is indicated, begin by changing the tube. If the tube was not at fault, change the module after turning off the Unit. The location of each module is indi-

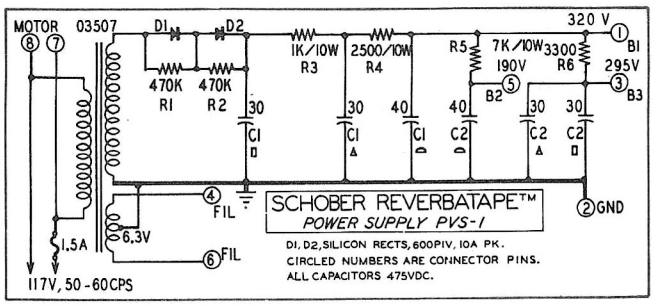

Fig. 5 — The Reverbatape Power Supply.

cated by the lettering on the back plate, which is removed to get at the modules by taking off the three 6-32 nuts. The modules themselves are identified by the last three letters of the number which are printed in copper along with the letter U or L.

When inserting modules feel gently for the correct orientation of the plug pins with respect to chassis sockets. Do not force, as this will bend plug pins. When finished, replace the cover. Before tightening the three nuts, see that each tube is *centered* in its circular cutout.

No service manual can list in detail all the faults which are possible in a piece of electromechanical equipment. This is a good reason to read earlier parts of this manual (and the technical article) thoroughly to gain an understanding of how the Unit works.

Even if you cannot determine in advance which module is at fault, you can always resort to replacement of all of them, one by one. The same is, of course, true with tubes.

TROUBLESHOOTING CHART

Symptom	Probable Repair
1. No reverberation with control fully advanced.	Modules V1, V2, V6, or V7. Clean heads. Defective record head or playback head #3.
2. Separate repetitions audible and not regularly spaced.	Modules V4, V5. Clean playback head #1 or #2.
3. No output at all.	Module V8. Blown fuse.
4. Tape does not move or speed is irregular.	Clean rubber drive roller with alcohol. Press rubber roller momentarily against motor shaft.
5. Oscillation builds up with control fully advanced; or insufficient reverberation.	Change tube V1 or V6. Return Unit to factory for recalibration.
6. Output distorts at high volume and high control settings.	Use higher-number attenuator.
7. Noise or sound heard, with no input.	Module V3. Clean erase head.
8. Reverberation intermittent at some control settings.	Rotate control rapidly or use contact cleaner to clean the resistance elements. Change control if necessary.
9. Excessive hum, increasing with higher control settings.	Main Unit too close to Power Supply or other hum-producing field.